

# Thailand's Pilot CDM Program for Livestock Waste to Energy

**Methane to Markets Partnership Expo  
Beijing, China  
31 October 2007**

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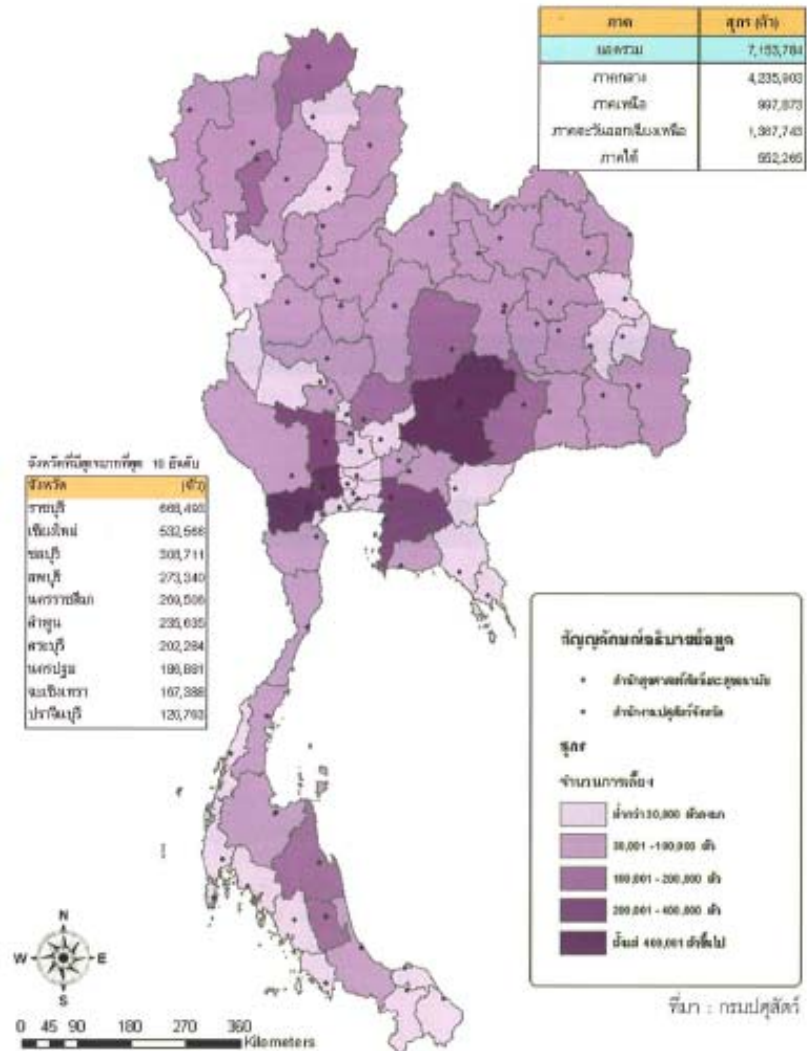
# Presentation Outline

- Background on current waste handling
- Treatment technologies
- Technologies comparison
- Policies and Regulations
- Thailand's Pilot CDM Program for Livestock Waste to Energy



# Background: Swine Raising Sector

- Thailand has around 7.14 million of swine population
- The government has listed swine farm as one of the major point source of pollution that need to be regulated
- Most swine farms are concentrated in three river basins: Mae Klong, Tha Chin, and Bang Pakong



# Background: Characteristic of Swine Farms

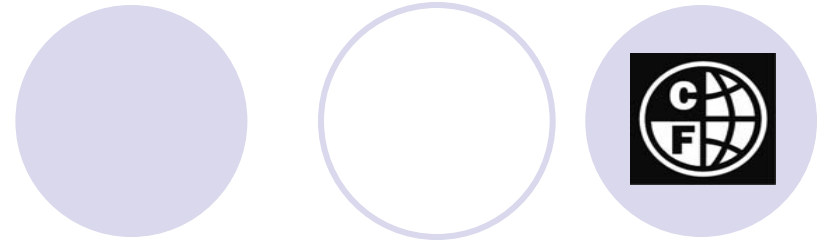


- Large and medium size farms account for almost 60% of the total swine population
- Large farms tend to have sufficient capacity to manage their waste
- Large farms also sub-contract swine raising to small farmers with little or no support for waste management

Farm Size	No. or pigs	No. of Farms	Total Pigs head (million)
Small	50-500	>200,000	3
Medium	500-5,000	1,309	1.36
Large	>5,000	186	2.78

Source: Department Livestock Development, 2006

# Background: Waste Handling



- **Most large and medium size farms operate closed water cycle systems, with final effluent recycling and little or no discharge to the aquatic environment. However, run-off is not unusual during the rainy season.**
- **Solid manure is often separated and sold as organic fertilizer. The rest of the waste is channeled to the open anaerobic lagoon with more than a month retention time**

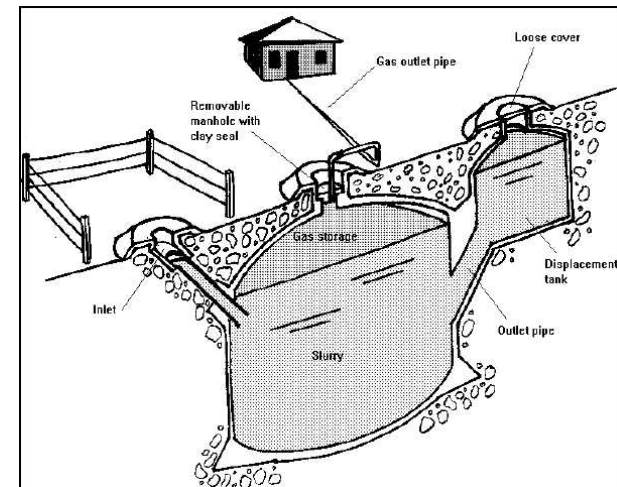


A typical Medium Size Swine Farm  
with Open Anaerobic Lagoon

# Treatment Technology: 1st Generation of Anaerobic Digestion



- **Fixed Dome** works like a septic tank
- Implemented by the Department of Agriculture Extension since 1996-2004
- Installed 1,655 fixed dome biogas unit
- Total digester volume is 75,000 m<sup>3</sup>
- Government subsidized 45%
- Lack of proper maintenance will leads to system failure





# Treatment Technology: 1st Generation of Anaerobic Digestion



- **Covered Lagoon** works like a balloon filled with Methane and other gases
- Captured methane gas is used for heating and electricity generation
- Modified diesel engine is normally used as the electricity generating unit
- Lack of proper design and high quality material and maintenance will lead to limited methane generation and system failure



# Treatment Technology: 2nd Generation of Anaerobic Digestion



- **Channel Digester + Up-flow Anaerobic Sludge Blanket (CD + UASB) and High suspension solids – Up-flow Anaerobic Sludge Blanket (H-UASB) use more sophisticated techniques to digest waste from swine farm**
- **The technology modified from an imported prototype in 1984**
- **Installed 150 plants in medium-large swine farms**
- **CD + UASB, remove 80-90% COD**
- **Government subsidy with funding from the Energy Conservation Fund**





# Technology Comparison



	<b>Biogas System</b>			
	<b>Fixed Dome</b>	<b>CD+UASB</b>	<b>H-UASB</b>	<b>CL</b>
<b>Optimum Load Capacity</b>	<b>Small</b>	<b>Medium-Large</b>	<b>Medium-Large</b>	<b>Small-Large</b>
<b>Head Retention Time (HRT)</b>	<b>Medium</b>	<b>Low</b>	<b>Very low</b>	<b>High</b>
<b>Organic Removal (%)</b>	<b>60-80</b>	<b>80-90</b>	<b>80-90</b>	<b>60-80</b>
<b>System Stability</b>	<b>High</b>	<b>High</b>	<b>High</b>	<b>Medium</b>
<b>Maintenance Cost</b>	<b>Medium</b>	<b>High</b>	<b>High</b>	<b>Low</b>
<b>Operation skill requirement</b>	<b>Medium</b>	<b>High</b>	<b>High</b>	<b>Low</b>
<b>Environmental Impact</b>	<b>Medium</b>	<b>Low</b>	<b>Low</b>	<b>Medium</b>
<b>Capital Cost (USD/m<sup>3</sup>)</b>	<b>47</b>	<b>132</b>	<b>235</b>	<b>Low</b>

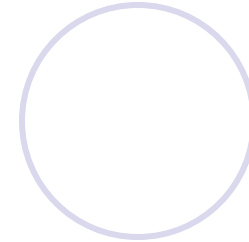
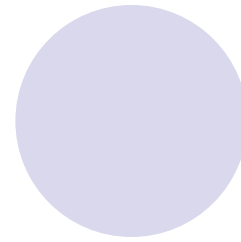
# Policies & Regulations



- Ministry of Natural Resources and Environment Notification , Subject: Effluent discharge from swine farms (released 29 December 2005)
- Most farms operate under closed system and do not release any effluent to natural water courses
- There is no regulations imposed on greenhouse gas emission
- A Standard Farm regulation issued by the Department of Livestock Development

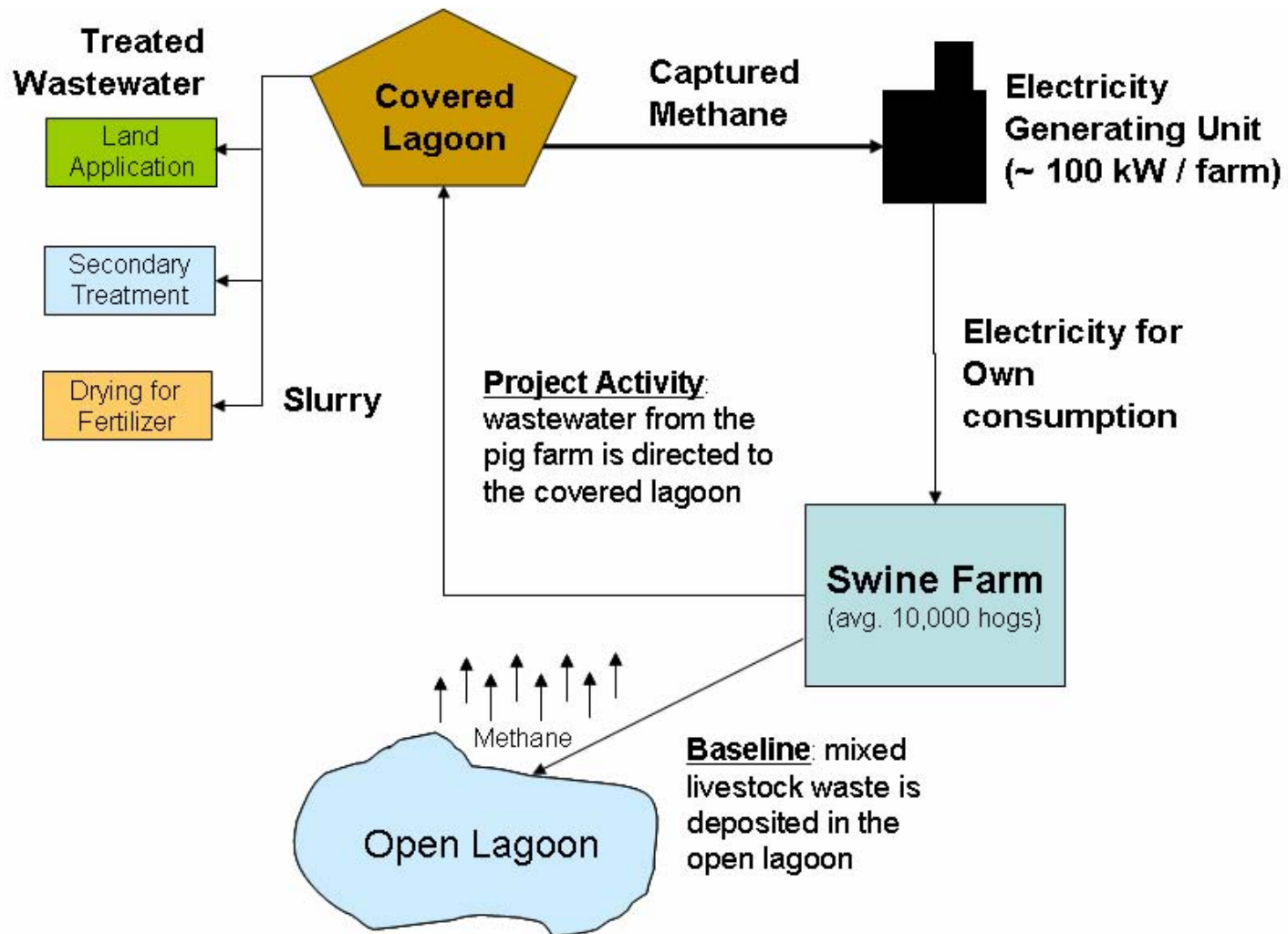
<b>Effluent Standard (mg/l)</b>	<b>Large Farms</b>	<b>Medium-Small farms</b>
<b>BOD</b>	<b>60</b>	<b>100</b>
<b>Suspended Solids</b>	<b>150</b>	<b>200</b>
<b>COD</b>	<b>300</b>	<b>400</b>
<b>TKN</b>	<b>120</b>	<b>200</b>

# Pilot CDM Project



- **Partner:** Department of Livestock Development and Advance Energy Plus Co. Ltd. (bundling agent), and swine farmers (10-12 farms with an average of 10,000 hogs per farm).
- **Location:** Three priority river basins
- **Baseline:** open anaerobic lagoon
- **Methodology:** AMS III.D.
- **Estimated Emission Reductions (ERs):**  
60,000 tCO<sub>2</sub>e/year
- **Contract Period:** Purchase ERs beyond 2012
- **Social Benefits:** Community Benefit package

# Selected Technology



# Community Development Carbon Fund



- The CDCF provides carbon finance to projects in poorer areas of the developing world that combine community development with investment in clean energy.





# Community Benefits



- The unique feature of CDCF projects has always been their community development aspect.
- In its third year of operation, the CDCF has developed stricter criteria for assessing community benefits, reviewing community benefit plans, ensuring that communities are consulted and participate in defining benefits and verifying that such benefits are in fact delivered to communities before payment is made to the project developer.

# Shared Lessons Learned



- Clearly define the ERs ownership and benefit sharing arrangement
- Reduce transaction cost by bundling
- Reduce capital cost by buying in bulk
- Ensure baseline conditions
- Ensure compliance with environment and social safeguard of Thailand and the World Bank
- Optimize the monitoring plan according to the AMS III.D. guideline
- Professionally designed and implemented waste treatment system to optimize the biogas generation
- Stakeholder consultation and participation in the design of the community benefit package



Thank you

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